CLAIMS

What is claimed is:

1. A method of coding speech using perceptual weighting, the method comprising
5   the steps of:

sampling a speech signal;

determining a pitch of the speech signal;

characterizing the voiced quality of the speech signal;

training a Lloyd-Max quantizer with the pitch values of those speech signals from

10   the determining step characterized as being substantially fully voiced in the

characterizing step; and

quantizing the pitch values from the training step and the pitch values of those

speech signals from the determining step not characterized as being substantially

fully voiced in the characterizing step.

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2. The method of claim 1, wherein before the training step further comprising a step of median filtering the pitch values of those speech signals characterized as being substantially fully voiced in the characterizing step, thereby removing pitch doubling errors.

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3. The method of claim 1, wherein the characterizing step includes the substeps of: dividing the speech signal into a plurality of frequency spectrum bands, establishing the voiced quality of the speech signal in each spectrum band, and describing the speech signal as being substantially fully voiced if a majority of the

10   plurality spectrum bands are established to be of a speech signal of a voiced quality.

4. The method of claim 3, wherein the dividing step includes five spectrum bands.

15   5. The method of claim 1, wherein the speech signal of the sampling step does not use error correction.

6. The method of claim 1, wherein after the sampling step further comprising the step of buffering the speech signal for a multiple of frames to be block quantized in

20   subsequent steps, wherein the number of buffered frames of speech is increased during periods of substantially voiced speech to enable more accurate coding during the subsequent steps.

7. The method of claim 1, further comprising the step of storing the quantized pitch

25   values in a memory for later decoding, synthesis and playback.

8. The method of claim 1, wherein the quantizing step quantizes using two bits per pitch value.

9.   The method of claim 1, wherein the determining step include determining a gain of the speech signal, the training step includes training a Lloyd-Max quantizer with the gain values of those speech signals from the determining step characterized as being

5   substantially fully voiced in the characterizing step, and the quantizing step includes quantizing the gain values from the training step and the gain values of those speech signals from the determining step not characterized as being substantially fully voiced in the characterizing step.

10   10. The method of claim 1, further comprising the step of synthesizing speech, wherein a substantially fully voiced speech signal is synthesized using a pitch periodic excitation train and a speech signal that is not substantially fully voiced is synthesized using a lowpass filtered pitch periodic excitation signal mixed with highpass white noise.

15   11. The method of claim 10, wherein the synthesizing step includes using pitch periodic excitation trains with substantially flat spectral response.

12. A method of coding speech using perceptual weighting, the method comprising the steps of:

sampling a speech signal

buffering the speech signal for a multiple of frames to be block quantized in

5   subsequent steps, wherein the number of frames of speech being buffered is

increased during periods of substantially voiced speech as determined in the

subsequent steps;

determining a pitch of the speech signal;

characterizing the voiced quality of the speech signal;

10   training a Lloyd-Max quantizer with the pitch values of those speech signals from

the determining step characterized as being substantially fully voiced in the

characterizing step;

quantizing the pitch values from the training step and the pitch values of those

speech signals from the determining step not characterized as being substantially

15   fully voiced in the characterizing step; and

synthesizing speech, wherein a substantially fully voiced speech signal is synthesized

using a pitch periodic excitation train and a speech signal that is not substantially

fully voiced is synthesized using a lowpass filtered pitch periodic excitation

signal mixed with highpass white noise.

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13. The method of claim 12, wherein the determining step include determining a gain of the speech signal, the training step includes training a Lloyd-Max quantizer with the gain values of those speech signals from the determining step characterized as being substantially fully voiced in the characterizing step, and the quantizing step includes quantizing the gain values from the training step and the gain values of those speech signals from the determining step not characterized as being substantially fully voiced in the characterizing step.

14. The method of claim 12, wherein the sampling step is performed at a variable sampling rate wherein the sampling rate is increased during periods of substantially voiced speech and decreased during other periods.

15. An apparatus for coding speech using perceptual weighting, the apparatus comprising:

a buffer, the buffer inputs a speech signal and stores samples thereof;

a pitch detector coupled to the buffer, the pitch detector determines a pitch of the speech signal;

a voicing analyzer coupled to the pitch detector; the voicing analyzer characterizes the speech signal as to whether it is substantially fully voiced; and

a Lloyd-Max quantizer coupled to the voicing analyzer and pitch detector, the quantizer is trained with and quantizes the pitch values of those speech signals from the voicing analyzer characterized as being substantially fully voiced, the quantizer also quantizes the pitch values of those speech signals from the pitch detector not characterized as being substantially fully voiced.

16. The apparatus of claim 15, further comprising a median filter coupled between the voicing analyzer and quantizer, the median filter filters the pitch values from the voicing analyzer to remove pitch-doubling errors.

5   17. The apparatus of claim 15, wherein the buffer buffers a multiple of frames to be block quantized in the quantizer and increases the number of buffered frames of speech during periods of substantially voiced speech to enable more accurate coding.

18. The apparatus of claim 15, further comprising a gain detector coupled between
10   the buffer and quantizer, wherein the quantizer is trained with and quantizes gain values of those speech signals from the voicing analyzer characterized as being substantially fully voiced, the quantizer also quantizes the gain values of those speech signals from the gain detector not characterized as being substantially fully voiced.

15   19. The apparatus of claim 15, further comprising a speech synthesizer coupled to the quantizer, wherein a substantially fully voiced speech signal is synthesized using a pitch periodic excitation train and a speech signal that is not substantially fully voiced is synthesized using a lowpass filtered pitch periodic excitation signal mixed with highpass white noise.

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20. The apparatus of claim 19, wherein the speech synthesizer includes using pitch periodic excitation trains with substantially flat spectral response.